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A Cerebrospinal Fluid Leak Presenting as Epiphora

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Abstract

A fifty-two-year-old female underwent a right frontotemporal craniotomy for microsurgical clip obliteration of a ruptured right dorsal variant ophthalmic segment carotid aneurysm. During the craniotomy, a defect involving the orbital roof was inadvertently created. The patient was noted postoperatively to have fluid egressing from her right eye. The fluid was analyzed and based on glucose and chloride levels was determined to be cerebrospinal fluid (CSF). Computed tomography (CT) scan of the head demonstrated the orbital roof defect created during surgery. After placement of a lumbar drain, fluid egress from the eye significantly decreased, further confirming the suspicion for CSF leak. Patient was found to have a conjunctival defect of the right eye, approximately 2.5 cm × 1.5 cm, extending to the fornix from 9 to 12 o'clock. The conjunctival defect and fornix was repaired with an amniotic membrane graft and a temporary tarsorrhaphy with subsequent resolution of CSF egress. The case report is in compliance with the Health Insurance Portability and Accountability Act.

Case Report

A fifty-two-year-old female underwent a right frontotemporal craniotomy for microsurgical clip obliteration of a ruptured right dorsal variant ophthalmic segment carotid aneurysm. The perforator attachment to a high speed pneumatic drill was utilized to create burr holes at the surgical keyhole above the pterion, along the superior temporal line and above the zygoma, and a pterional frontotemporal craniotomy was performed using a straight drill attachment with a footplate. After elevation of the bone flap, the orbital roof was noted to be very thin and a defect measuring approximately 1 cm × 1.5 cm was visualized posterior to the orbital rim, on the antero-lateral aspect of the orbital roof. A portion of the periorbital protruded through the defect and a breach in the periorbital was also noted with protrusion of orbital fat. The periorbital and fat were gently coagulated and covered with oxidized cellulose

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(SURGICEL Original Absorbable Hemostat; Ethicon, **New Brunswick, NJ**). At the conclusion of the procedure, the orbital roof defect was covered with titanium mesh.

Immediately post-operatively, the patient complained of tearing from the right eye. On exam, the patient's vision was 20/20 OU, Ishihara plates were 11/11 OU, and no relative afferent pupillary defect was noted in either eye. Persistent egress of serosanguinous fluid from the right eye was noted. Extraocular motility was limited in supraduction and ptosis was noted, initially thought to be secondary to a partial third nerve palsy attributable to surgical intervention. Anterior segment exam revealed a conjunctival defect of the right eye, approximately 2.5 cm × 1.5 cm, extending to the fornix from 9 o'clock to 12 o'clock. A subconjunctival hemorrhage was noted in the area adjacent to the defect without any findings of a ruptured globe. After instillation of fluorescein dye, a stream of clear fluid originating from the superotemporal fornix was noted. This fluid was found to have a glucose of 95 mg/dl (normal CSF glucose 50-80 mg/dl or 2/3 of the serum glucose level [measured to be 181 mg/dl in the patient's serum 3 hours prior to fluid collection], normal tear glucose level less than 26 mg/dl) and chloride of 126 mmol/l (normal CSF chloride 110-125 mmol/l, normal tear chloride 120-135) consistent with CSF.^{1,2} A noncontrast head CT scan demonstrated a craniotomy defect involving the anterolateral aspect of the orbital roof, which appeared fragmented and covered by a metallic mesh (Fig 1). A small amount of air was identified below the mesh and small bone fragments appeared to be depressed into the orbit and encroaching upon the superior rectus muscle. The eyelids were patched closed and the patient was placed on moxifloxacin ophthalmic drops.

Once the diagnosis of oculorrhea was made, a lumbar drain was placed to diminish the egress of fluid from the eye to allow for possible spontaneous closure of the wound. The following day, slow fluid egress persisted that greatly increased with clamping of the lumbar drain further confirming the diagnosis of a CSF leak. Given the large size of the conjunctival defect and the brisk nature of fluid egress, spontaneous cessation of the leak seemed unlikely with a lumbar drain alone. Thus, a plan was made to repair the conjunctival defect the next day, approximately thirty-six hours after the initial presentation.

In the operating room, the patient was noted to have a 1.7cm × 2.0cm defect of the conjunctiva and Tenon's capsule starting approximately 5-8 mm from the limbus (Fig 2). This defect was located from 9 o'clock to 12 o'clock and extended to the fornix with persistent egress of fluid (see video). The temporal aspect of the superior rectus muscle fibers as well as the superior fibers of the lateral rectus muscle could be directly visualized in the area of the defect. Amniotic membrane placement was chosen as the method to repair the defect. Initially, the amniotic membrane (AmbioDry; OKTOS Surgical Corporation, Costa Mesa, CA) was laid flat over the defect with fibrin glue (Tisseel; Baxter Healthcare Corporation, Glendale, CA). However, the membrane did not adhere due to persistent fluid accumulation. Neurosurgery therefore increased the CSF outflow from the lumbar drain and the head of the bed was elevated approximately 10 degrees decreasing the egress of fluid. The amniotic membrane was then secured to the edges of the conjunctiva using multiple interrupted 8-0 polyglactin sutures medially, laterally, and anteriorly. Sutures were also placed as posterior as possible securing the graft to the globe with lamellar passes through the sclera. Finally, a large diameter bandage contact lens was placed and the eyelids were

closed with a temporary suture tarsorrhaphy. A gentle pressure dressing was placed over the right eye prior to conclusion of the case. Post-operatively, the lumbar drain remained open draining CSF at 10-15 cc/hr.

Starting from post-operative day one, CSF no longer leaked from the eye. Four days after the conjunctivoplasty, fornix reconstruction, and tarsorrhaphy, the lumbar drain was clamped and subsequently removed after it was confirmed the patient no longer had a CSF leak. The suture tarsorrhaphy was removed 6 weeks from time of placement with the conjunctival defect and fornix completely epithelialized without fluid leak. Six months after the repair, the patient continues to remain asymptomatic without any CSF leak.

Discussion

CSF leaks into the orbit are rarely reported in the ophthalmic literature but do occur as a complication seen after various orbital surgeries, including external^{3,4} and endonasal^{5,6} dacryocystorhinostomy (DCR), orbital decompression⁵, and orbital exenteration.⁷ In these cases, the CSF leak presents as rhinorrhea, instead of tearing. To our knowledge, there has never been a reported case of a CSF leak presenting as epiphora following a craniotomy.

The two most common causes of CSF leak have been reported to be accidental trauma (44%) and surgical trauma (29%).⁸ The most common site of the CSF leak has been shown to be at the cribriform plate (35%), followed by sphenoid sinus (26%), anterior ethmoid (18%), frontal sinus (10%), posterior ethmoid (9%) and inferior clivus (2%).⁹ In this case, the site of the CSF leak was expected to be in the orbital roof given the location of the craniotomy and operative findings. The defect in the orbital roof was noted intra-operatively and later confirmed by a CT scan.

Joshi et al. reported on an eight-month-old child who developed a traumatic CSF fistula, which presented as tearing.¹⁰ CT demonstrated a fracture involving the ethmoidal air cells, which was confirmed during surgery. Repair was performed from above to reposition the herniated brain from the fracture site. In another report, Dryden et al. reported on a four-year-old child who had chronic CSF leakage presenting as tears following midface trauma.¹¹ In this case, the tearing simulated a lacrimal duct obstruction leading the patient to undergo a DCR, which did not resolve the tearing. The CSF leak was subsequently repaired via a craniotomy approach.

In patients with a suspected CSF leak presenting as epiphora, glucose and chloride can be measured in the fluid. Additionally, a beta-2-transferrin level can be obtained, but this is frequently a laboratory test that needs to be sent out, possibly delaying the diagnosis. In our patient, given the recent craniotomy for clipping of an aneurysm complicated by an orbital roof defect, the epiphora that developed postoperatively was concerning for a CSF leak. Glucose and chloride levels as well as the cessation of the leak with the lumbar drain confirmed our suspicions. In order to avoid a craniotomy or orbitotomy for repair of the orbital roof, a less invasive approach with repair of the conjunctiva and fornix was pursued.

During the craniotomy approach, an inadvertent defect was created at the anterior aspect of the orbital roof. We hypothesize the neurosurgical drill penetrated through the orbital roof

into the soft tissue of the orbit causing tissue drag resulting in injury to the upper fornix, conjunctiva, Tenon's capsule, levator muscle, and superior rectus. The herniated orbital fat noted intra-operatively as well as the postoperative clinical findings of ptosis, supraduction limitation, and exposed bare sclera supports this hypothesis.

Management of CSF leaks should follow a graded approach. The first step is often observation with bed rest, elevation of the head, and avoidance of any maneuver that would increase intracranial pressure.⁵ In addition, some surgeons will initiate antibiotics to prevent meningitis although evidence is lacking in supporting its use.¹² All of these measures were attempted in our patient without success due to the briskness of the leak. A decision was then made to place a lumbar drain to stop the leak and tape the eyelids shut in hopes of allowing the wound to granulate. Although the drain did decrease the egress of fluid, the leak persisted, increasing significantly once the drain was clamped. Therefore, given the size of the conjunctival defect and the brisk nature of the CSF leak, the oculoplastics team in conjunction with neurosurgery felt it was necessary to repair the defect to promote re-epithelialization and ultimately halt the CSF leak without unnecessary delays. The conjunctiva and fornix was reconstructed with amniotic membrane and the eyelids were sutured shut with a temporary tarsorrhaphy in hopes of immobilizing the eye. This technique proved successful, as the patient no longer had any leak of fluid from the eye post-operatively.

Conclusion

CSF leak presenting as epiphora has rarely been reported in the literature. Checking glucose and chloride levels can help to differentiate CSF from tears. To our knowledge, we present the first case of such a clinical presentation after a neurosurgical procedure. This leak was successfully treated with repair of the conjunctiva and fornix defect using amniotic membrane and placement of a temporary tarsorrhaphy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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PRÉCIS

A case of cerebrospinal fluid leak presenting as epiphora after a neurosurgical procedure successfully treated with fornix reconstruction.

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Figure 1.
CT orbits. A, B. Coronal sections showing superolateral orbital roof defect with titanium mesh. C. Sagittal section revealing extent of orbital roof defect.

Figure 2.
Intraoperative photo. Extensive conjunctival defect noted extending posteriorly to the fornix.
Video. Intraoperative video. Slowly accumulating cerebrospinal fluid noted in the upper fornix.